

FIG. 1

The Genomic Structure of the Mouse *Csx/Nkx2-5*

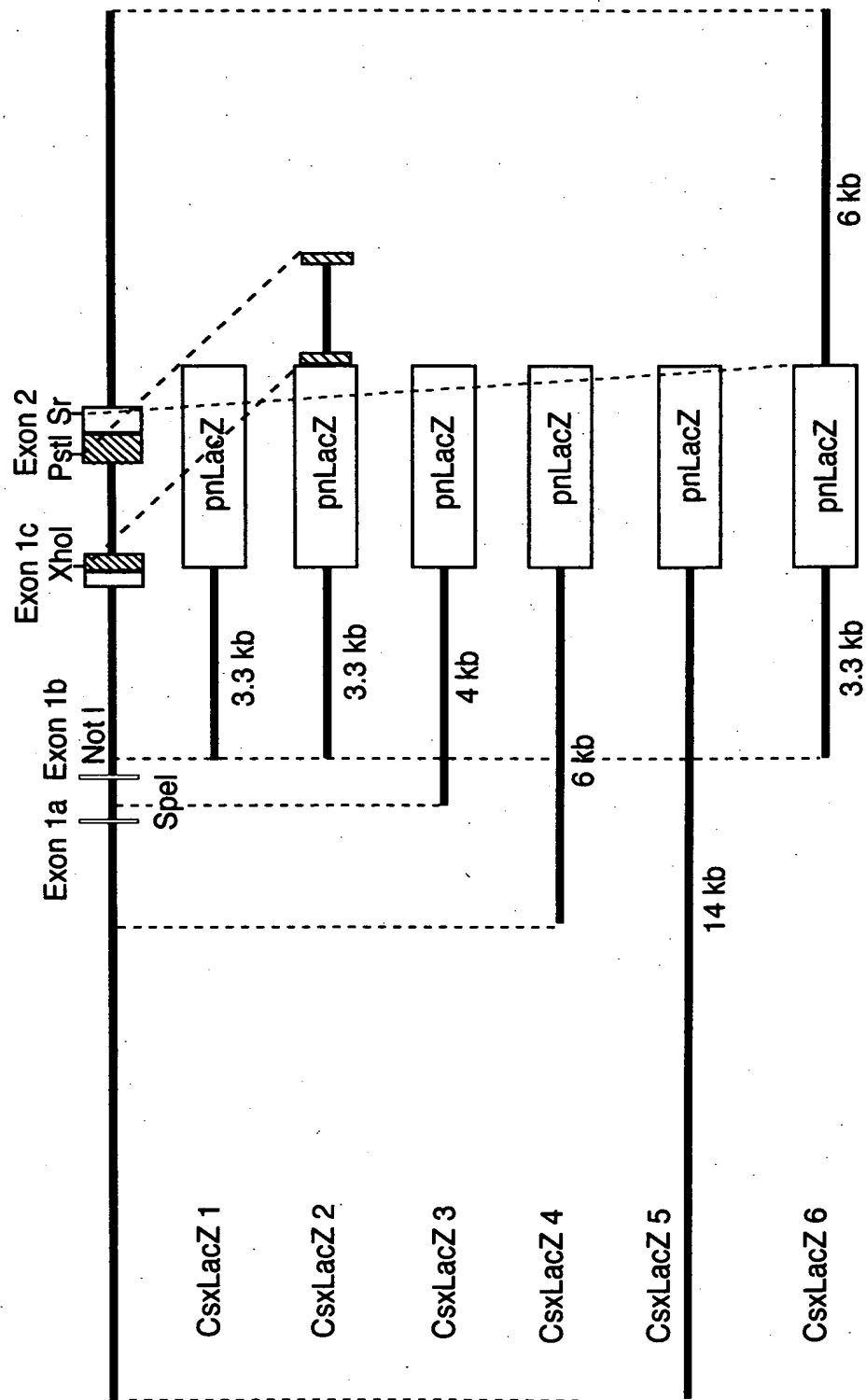
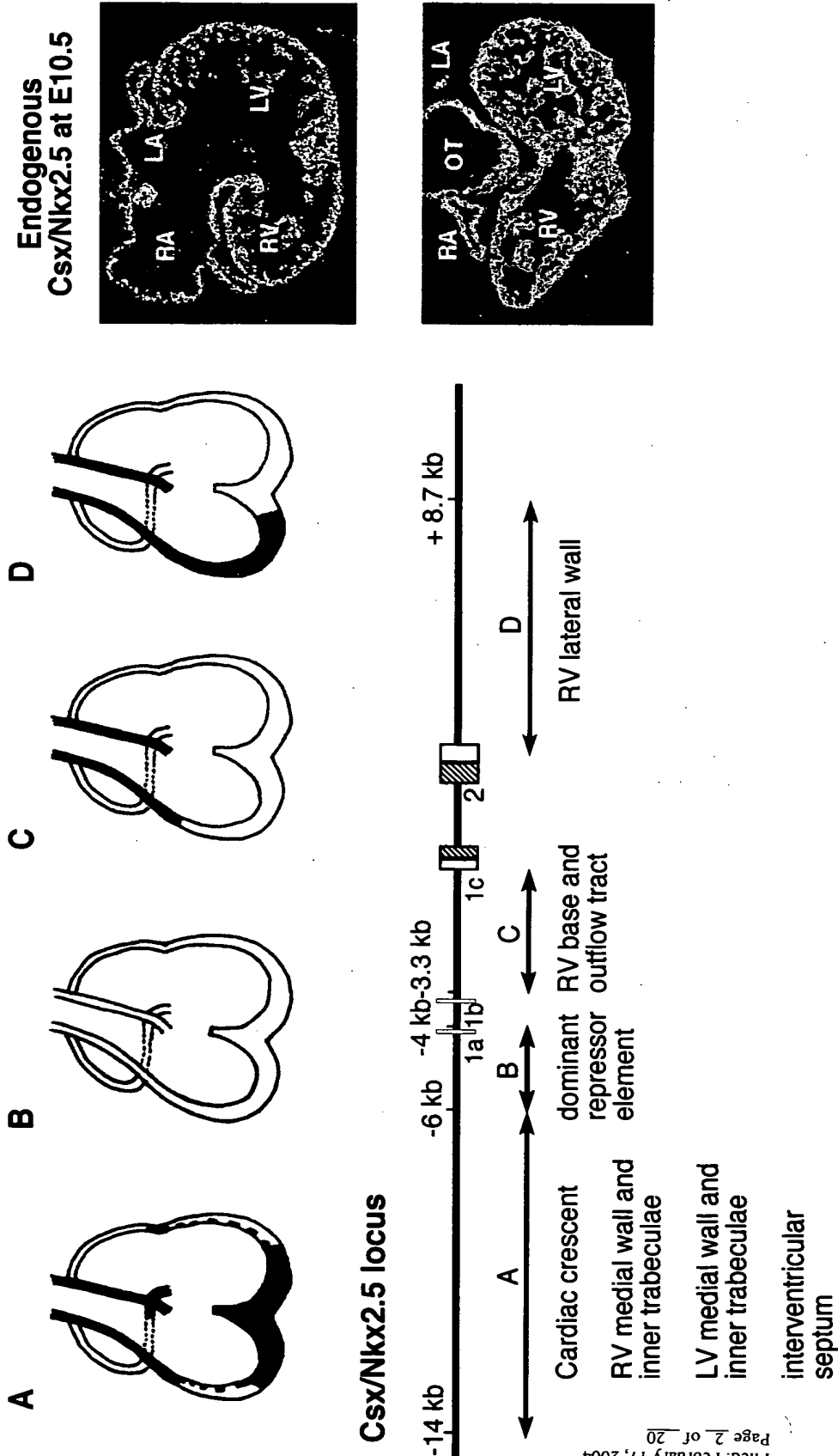


FIG. 2

The Locations of the Csx/Nkx2-5 Cardiac Enhancers



The diagram illustrates the hsp68 gene structure and various reporter constructs. The top part shows the hsp68 gene with exons 1 and 2, introns, and various restriction sites (NotI, ScaI, XhoI, EcoRI, HindIII, XmnI, PvuII, XbaI, BglII, EcoRI, NotI, HindIII). The bottom part shows various hsp68-lacZ reporter constructs with different lengths (20 kb, 7.5 kb, 3.5 kb, 4 kb, 1 kb, 0.7 kb, 0.3 kb) and a pnlacZ construct (1.4 kb).

[illegible]

FIG. 3B

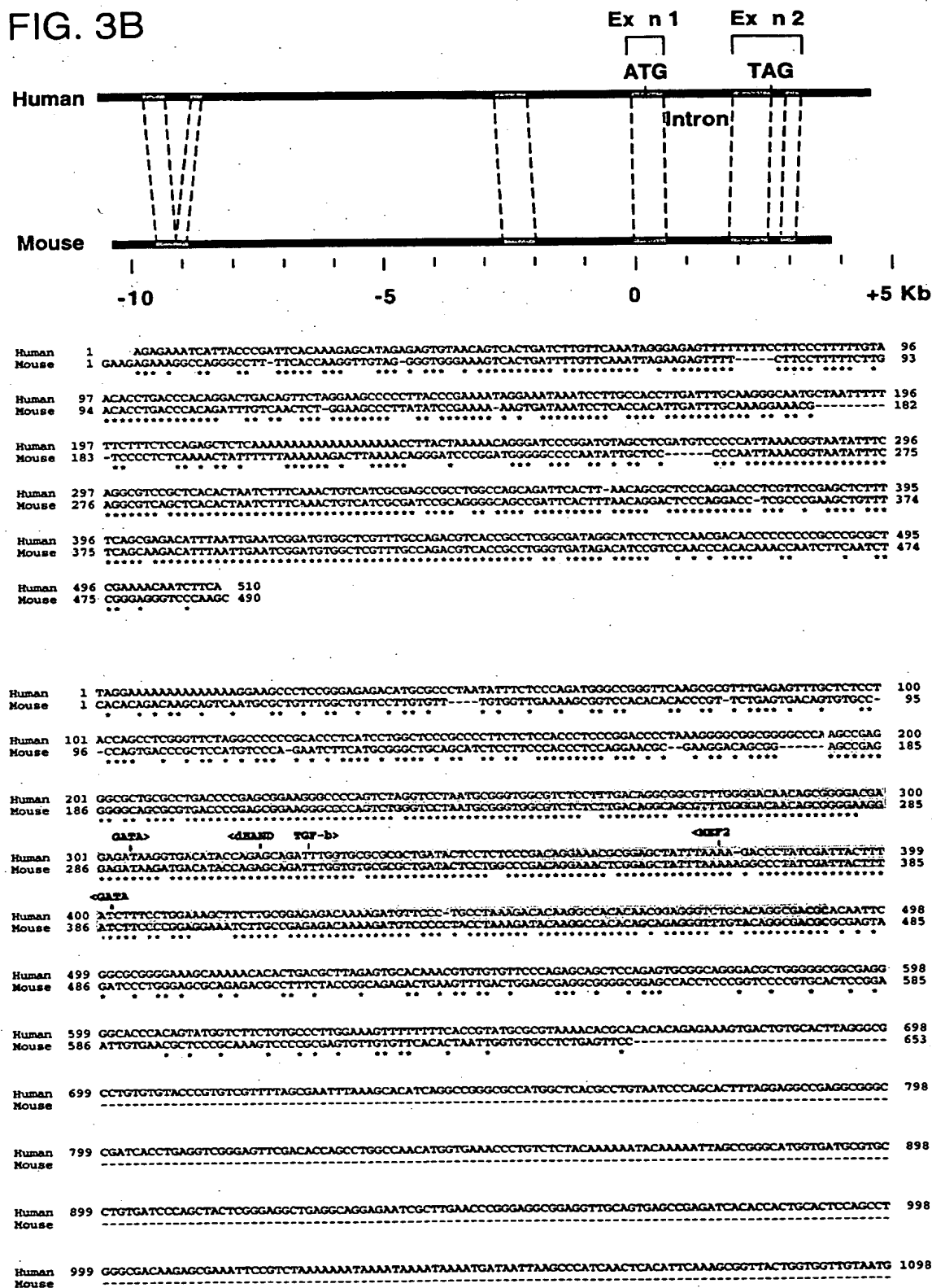


FIG. 3C

**The Genomic DNA Sequence Homology
Between Human and Mouse Csx/Nkx2-5**

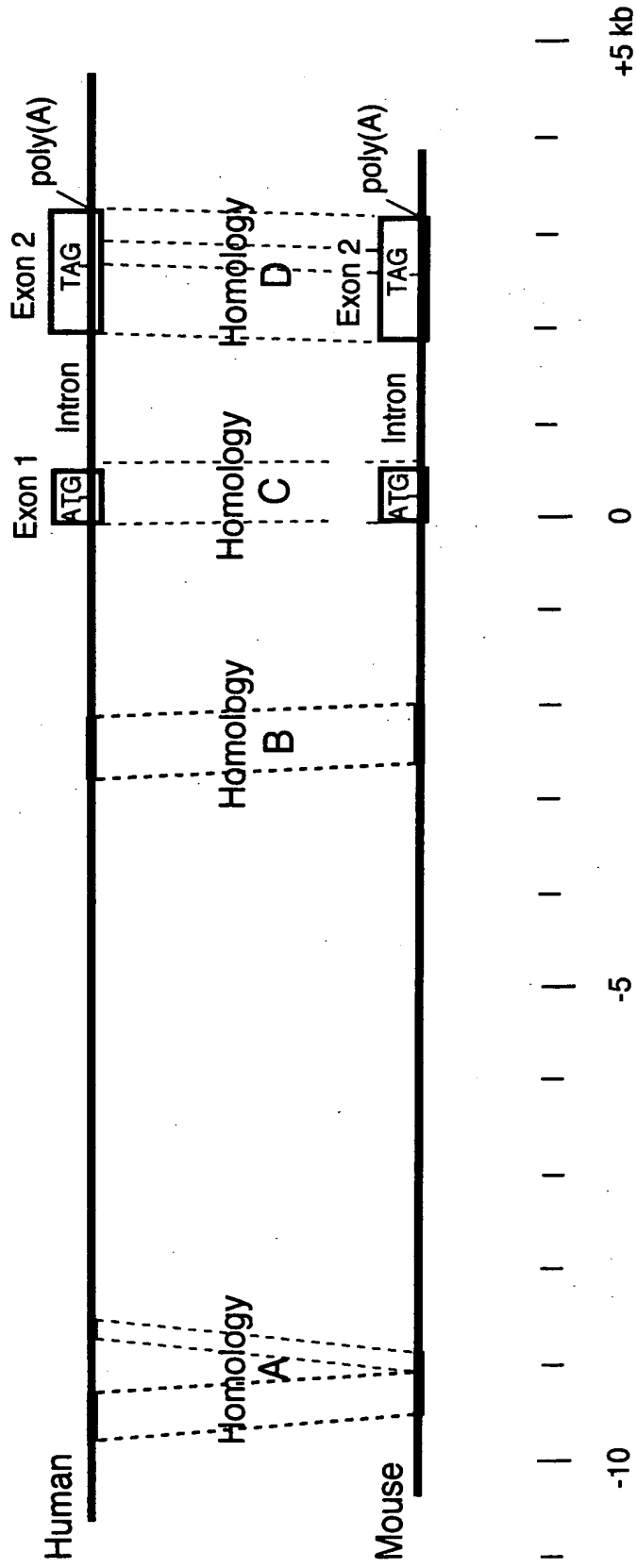


FIG. 4A (1)

CTCAGAGCCAGGAGTTCAAGACCAGCCTGGGAAACATAGGGAGACCCC
TCTCTCTCCACAAAAAATTTAAAACTAGCCAGGTGTGGTGGCAAACA
CCTGTAGTCCCAGCTACTCAGAAGGCTGAGGTGGGAGGATCACTTGAG
CCTGGAAAGTAGAGGCTACAGTGAGCCGTGATCACACCACTGCACTCC
AGCCTGGGAGACAGAGTGAGACCCTGTCAAATAAATAAACAAACAAAT
AATGATTAAATAACTAAACTAATTTTATGCTATTTTCACCTTGAT
TTTGTAAGATTTTTTAAATGAAAATTCCTCAAATTGCTTTCCAGAAGG
ATTGTTCAAATTATACCCACATTTCACTCATGTTCTCTTCCTGAACA
GCAGCAATCAGGAAAACTCCCTGGAAAGAGGCAGGGCTTAGACTGAGA
TTTTAAAAGGGGGTAGGCCTCAGCTCTCCTTCCAGGTTTACACTGTGC
ATGTTTCCAACTCAAAGAATTTACACTCTTCTGGTTGCATTGCTCTG
TAAAGATCTGACCCACTACTATGTATTAAAAAGGGATGCATGATAATG
AATTCAGCCCTCTCTGTAAAATCCAAAGGGTCCTATTGCAGTTTCCCC
CATTTAATGGGTCAATTAATAATTTCTTGGGAAGGACAAAGCTTTAGTT
AACTATGAGAAAAACAAGCAGAACCAGCCCTGGATTCTGTCTTCAAAG
ATTTTACCATGTTGGCAGGCCTGGTAGTCCAGAGCCCAAGAAAATATC
CCAGCCACAGATACCCTAGATGTAGACTAGCAGTGCTACAACCTCAAG
GTCAGAAGTATGTCACTAGACCAGAGCCAAAAATAGGTGCTATATCAT
TAAGAGAGTAAAAATGCAAACCACAGACAGGGTGACATTATTCACAAAT
AAGCATATAACCCACAGGGGACTCCTATCTGAATATGCAAAGAACTCT
CACTAATCAATAAGAAAAAGGCAAAAGATTTAAACAGGCACCTTCACAA
AAAAAGTATATTCAAAAAATCAATAAACATTTGAAAAGATCCTCAATT
CACTAGTTATTAGGGAAAGGTGAAATAAAACCACAATGAGACACCCCC
ACGCCCCCACCAGAACGGCTTAAATCTAAAACATGTAATACCGAATG
TTTGCAAGGATGCGGAGAACTGCCATTTTTGTACACTGCCAGTATGA
GGGTAAATCTGTACAACCAGGTTGGAAAACGCTGAGTAGAATGTACTC
TAGCTGGATTTGTGAATATCATATGATCCAGCAATTCTACTCCTAGAA
ATTTACCCAACAGAAATGTGTAAACATGTTTACCAAAGACACACGCA
AGACAATTCATAGAGGCACTCACTATTCCTAACAGTCAAAAAGTGGAA
ACTACCCAAATGTCCATCAGCAGAGAATGGCGATAAACAGTAGCATCT
TCACATAATGAAATGTTTCGACAGCAATGAAAAGTAGCTAGCTACAAC
TACAAACAATGTGATTGAACCTCACAAACATATACTAAGTAAATTTAT
CAGACACAAAGAGTGTATATACTGTATTTAGATACATGTGAAGTCTGA
AAACAGGCAAAAGTATTCTGTTGTTAGAAGTCAGAAAGTTACTGCC
TGCCGGGAAACAGAACTCAAGAGGGCTTAGTAGCTACTGGTAATGTTT
TGCTTCTGAACTGCATGCTAGTGAGGCAGCTGTTATTTTGTGCAGTC
CTGTGTTACACTGGAGTTAAAAGTTCCCCCAAATCAGAAAGTGTTC
GCAAGTGGAAGCAAGTACACTGCTGGACTTGGCTGGGAAGTTAGGGGA
TCCCATAATTTGTACAGGCACAAGCAAAGCCAGCTTTCTTGCCNTAA
GTAGCATCTCCCAGAGTCAGGATCCAGGAATGGTTTGGCAGGCAGGAT
GCAAGGCAGGATTCGGGAGTGGCTGAGAGTTTTCCAGTGCCACCTGG
TCCCACCTCCCCTCTCCCACTTCTAATGAACGGGCAGTACAGCTTCTG
TTAGGAAAAGAGCCTGGGTCCCTAGGCGATGACTGTACATCTAGGGA
GAGGGCGATGCACTGGGGTCTCACCTACACCCCCCTTGGCTGTCTCA
CCTCTGAATTATAAATGCCCGGACTTCCTCATCTCCCACCCACACA

FIG. 4A (2)

TCTTGTTAGAAGAAAAGAAACGAATCTCCCAGGGCTCCTTCTAACAAA
AGTGTTCAATTCAGAGTAGCCCTGCTTGAGGGCCCCTGGCCTGGAGGAG
TGGGAGAGGCAGCCCTCCCCCTCCAGGAGAGTCATCTCCAGGGCTACC
CAGGACTGAGTAACTAGGTCAACCAGAGTAACCAAAGAGGCAGGAGACA
AGGGCATTCAAGCATTGGGCCAGGAATGGAGGGTGATGTCCAGTTCAT
GTTCTTCTGGTTCCAGCATAGCACACGGTGCAAATGAACCATCATGCA
AGAAAACACAGCTAGTCTCCCTTCCTCCACCAGCAACCTTTGGTTACT
GATAATAATCAAATTCACTATTTTTTTTTTTTTTTTAACTAAGGCTGAG
ATAATGTCAAAGGACCACAGGGAATAGGAAGGCCATAACCAAGGCCCTT
AAAGAATGAGAAGAAGATTCATTCAAAAAGCCTCCTAAGGGAGGAAG
ATGTTTTTCCCTCCTTTACTTTTCTACAGTAATTTTTATTTTGGATAA
ATAAACCCCTGATAAATGAGAACCCACGCTTTCCCAAGGCCAGGCTGTG
TTTTGGTGGGTGGTCCTCCGTCAGCAGTTGGAGTAATCCAGAGTGATC
CCGGGCAAGTCGGAAGGGAGCAAGTCTGTGTTGAAGCCAAGAGGTATC
TTTCCCTACAGCTTCTCAAGAGAGGGGATCCCCGTGGGTAATTGTGAG
GCTGGAAACACCGAGAGGCTGACTCCCATGTTTATAGAGGTCATTGAT
GGGTTTGTGCATGGAAGGCAGGAGGAGACTGAGAGTGCTTTGTTATTG
TTATTTGGTTTATTTTTATTTTTAAAAAACTGGATCAGCCGACTTTGA
ATACAGAAAATGAAAATGAGGAGATTTGCATAACAGCGCTTGACGT
CTGAAGGGGGCCAGGGCCTAGCGGCTGGTGGGGCACCTAGAAACACTT
CTGCCTGCAGATCGCGGAGGGTTAGCCACAGGAAGGGGTGCGCTAGGC
TGGCCACAGGGCCTTTGCTGTGACTGAAGGACCAGCCTTGCGGCACC
TTCTTTCCCCTCTGCCCTGCACTCCGGCCCCGCGGAGTCAGAGCTGA
CTTGCTGCAGGTGGGGAGAGGACAGAGGCTAGGACGGTGGCGAAACC
TCACCTCGTCGCAGTCCGGAAGGTAAACTTGGACCCGGCAGGCACTTC
CTAAAGTCCAAGCTGCCCTCTCTGAAGAATAAACCTGATTTTCCTCCG
GACGCGGACAAAGGAGGATTCGCTCACAACCTAGCCTGTAACAAAGATT
CCCTATTTTCGTGGTTAGGAAAAAAGGAAGCCCTCCGGGA
GAGACATGCGCCCTAATATTTCTCCAGATGGGCGGGTTCAAGCGCG
TTTGAGAGTTTGCTCTCCTACCAGCCTCGGGTTCTAGGCCCCCGCAC
CCTCATCCTGGCTCCCGCCCCCTTCTCTCCACCCTCCCGGACCCCTAAA
GGGGCGGCGGGGCCCAAGCCGAGGGCGCTGCGCCTGACCCCGAGCGGA
AGGGCCCCAGTCTAGGTCCTAATGCGGGTGGCGTCTCCTTTGACAGGC
GGCGTTTGGGGACAACAGCGGGGACGAGAGATAAGGTGACATACCAGA
GCAGATTTGGTGCGCGCTGATACTCCTCTCCCGACAGGAAACGCGG
AGCTATTTAAAGACCCATCGATTACTTTATCTTTCTTGAAAGCTT
CTTGCGGAGAGACAAAAGATGTTCCCTGCCTAAAGACACAAGGCCACA
CAACGGAGGGTCTGCACAGGCGACGCACAATTCGGCGCGGGGAAAGCA
AAAACACACTGACGCTTAGAGTGCAAAACGTGTGTGTTCCAGAGCA
GCTCCAGAGTGCGGCAGGGACGCTGGGGGCGGCGAGGGGCACCCACAG
TATGGTCTTCTGTGCCCTTGGAAGTTTTTTTTTACCGTATGCGCGTA
AAACACGCACACAGAGAAAGTGAAGTGTGCACTTAGGGCGCCTGTGT
GTACCCGTGTCGTTTTAGCGAATTTAAAGCACATCAGGCCGGGCGCCA
TGGCTCACGCCTGTAATCCCAGCACTTTAGGAGGCCGAGGCGGGCCGA
TCACCTGAGGTGCGGAGTTGACACCAGCCTGGCCAACATGGTGAAAC

FIG. 4A (3)

CCTGTCTCTACAAAAATACAAAAATTAGCCGGGCATGGTGATGCGTG
CCTGTGATCCCAGCTACTCGGGAGGCTGAGGCAGGAGAATCGCTTGAA
CCCGGGAGGCGGAGGTTGCAGTGAGCCGAGATCACACCACTGCACTCC
AGCCTGGGCGACAAGAGCGAAATTCCGTCTAAAAAAATAAAATAAAAT
AAAATGATAATTAAGCCCATCAACTCACATTCAAAGCGGTTACTGGTG
GTTGTAATGTATCCATAGACACAGGTCTAAAATGTAAACGCTCCATTG
TGCTCCTTTTAAAGGGCTTGAATGTCTGCAACTGTATGTGTACACTTA
AAGTATGGGATGTGTCAACACGACCCTTTCTAGCGCGCTCGTTTCGTG
TCTGAATCCCCGCATTTTCGCCAATTTGCTTGGAGCGCAGAACGCCCTC
CGCGAAAGGCGGCTGCTGATCCCGACTTTGCTCCGGTATCGCGCAGCT
TGTTGGCCTCCGGGTCCCCCGTGCCATGCCCCGGGAGGCTCTCCACA
GACACCGCTTGCGCCGAATTATACGAGACTGAATGGGTTTTTTTGGTG
TGTGTGTGCAACACAACAATTTGTGAGCTGCTGTTCACAATGCGCTCC
GCCGGGCGGTGGAACTTGGCTGCGGTAACGCACAGCAGGTTGGAGGG
CACGACCCCGGAAGGAAGGAAGAGGCGAGGAGGGAAAGGCGGCGACCCT
AGGCCCGCTGGCCAGCCGTTTCCAGCATCAATTCAGCACTGAGCCGGC
CGCAGCAGCACAGGGCTGGGGGCTCCCGGAAGTTCGGCCAGCCGGGGT
TTGGGCCAGAGCCGCGGAGGCTGCCCGGTGGTAGGTGCGACTCTTCAC
CTCTCCGGGGAGCGGCGGCCGACGACCCAACCCACCCGCAAGCGCTGC
CGTCGGCCCCGGCTGGTCCCCCGCGCGGGCACAAAAACAGGCGGCAGTT
CGCCAGCTCTCTTTTCCCAAACCTGAACCGCCAAGCCGAAGGTTCTTC
CAAAGTCGCGGTTCCCCGGGCTTCACACCCGCGGGCAGGCGCGAACC
AGCCCCAGGACAACCATTTTCCCTCTTCACTGTATCTGAGTCGTTGTCC
ATCTGACTCGAATGTACCTGATTTTCCCAGCTGTGACCTCCAGCGAC
GGGACTCCGAGGAACTGATTCCAGCGTCTCGATTCTCTCCGCCTCTCC
GCCCGTTTTGGCTGAAGCGGTTTGCAGCCGTCGGGGCAGAAGGGGTGG
GATGTGGCAGCCACCAGCCCCAGCCAGAGAAGAAAAGAGGACGAAAT
TAACGCGAAAGGACACCGGAAGTCTGAAAGCGACTCCCTCGGATCCTC
GGAATCCGAGGCAAACCCTAACACTAGTTTGAAAGCGGATCATATCCA
CTAATCCAGGACAAATTCGGGTTGGGAAACATACTCCCAGAGCCTAA
GAAAACCTGACTTACAACAAAACAAACTGACAAGGACAAAATGCAAAG
GAGTTTGTGAAACGTAATTGCTCTCAGAAAATATGTGTATATATATAC
ATCCTATAATATGTTTTAAATTTGCAAAAAAAAAGTCTCTAAGAGGAT
ATATTTTTTAAAACCACTGGCAGCTTGGGAGGGAGTGGGGATTAGCTGA
GAAGGGGAGAAGGAAGCATTTTTGAGGTGACGTAAATGTTTTTGTATC
TTGATTATGGTGGCTGTTATGGGGGTGCACATCCAAGTGTCAAGACTC
ATCGAACTGTACACTTTTGTCTAGGTACATTAGACCTCAATAAAGTG
GATTTTAAACCTAAATAAGCCAGGTAACAGCTTTGCCTGGGTGGCTGG
GGGAGAGGCTTGGGACACTTTACATTGATCTCCCTCTTAGGCATGTTT
GTTTTGGTTTTGTTTTGTTCTTATGATGTATTATTTATTCAAAAATAT
ATCATTAGCAGAGTGACTGATGTAAATGTAAAACCATTTGTTAAGGAAA
CCAACAAAAGCGGGAACAAGAGACACTGGTGCATCCTGTTAGAGGGAT
AAGAATAAGCACTCGCTGTCCAAGCTCATAAAATATTTTGGGAATGAA
TGTCGTTCCGCTTTGTTTTTTTGGTTTTTTTGCTCATGTGTTTAACAT
CAACGAGAAATGAGGACCCAAAACCTTATCCAGTGGTTACGTGTGGTGT

FIG. 4A (4)

GTGTGGCTGTCATCTCCTTGGGACTGGCTACTGAAGGCCACAGGCGTG
GGAGGACCAAATGCTCCCTGGATGTTGAGTCCCAGCCGGTAAGCAGCA
CACAGTCCCGCTTGCAGCAAAGATGTGGTGGCCGGCTGCGCTGTGGGG
GAAGGCCAGGCCCGGACAGGAACCTCAGATCTCACC GGCGGATGAGAG
TGGTGGCCCCCTGCAGCTGGAGTCCCTGCTGGCCTGAGAGCTCCAGCTG
TGCCACCGTTGGGCAGACCCCACTTCAGGGAGCTGCCAGGATCAGT
GGCTACAAGAGTCCCCACCGTGTTTGGAGAACTAGGTATGAAATATT
TCCATTTACACCCCTACCCCGGCCCCAGACAGGAAAGTCACTTCAACC
TTGTTAGGTCAGATTCCAGATCTGGTTCAGATGCAGGGCTATTTT CAGA
GAGATTTTTAGAGGCTGACTCTCAGGAGAGGGAAGGACAGTGGGCTGA
AGGCCAGGGGT CAGGAAATCTAGGAACTGCTAAACTCCTCTGCTGGCC
TGCGGGGAGCGCCCGGGTGGGGCTACCAAGGCCACAAGCCAGTTCCAT
CTTCCCACTTTGCCACCTTCTCACAGGGACCAGGCTCTGCATCCTCAG
TGACCACAAGACTTGGGCCTGCCCTCTAGTTTGTCTATACCTGCCCCC
TCCCTTGACTCATACTGTCCAAGACCCCAAGACCAAACCACAAGTCAG
GAGAGATCTTGAGGGCAGCCAGTGCCACCAGGGTCTGTTCCCAGGTA
CTACTAGACAAAGGCCACCCTTCCTCCCCTCTCTCTAGGGCTCCGCTG
ACCACCCTGCACAGTCTTCCTACACCAAGGGCTCCGGTGCCACCCTT
CACAGAGAGTTCACTGCACCGCTGCTTCGGCTGCCTGTCTCAAACCAT
ACACACACCTTTGATTCTTAAACTCCAAGATTAGGATGGGCCCCAGAA
ATCTGCATTTTTTAATATGTACCTCAGAGGATTCTGGCCTAGATATTTT C
TACAGCCCCAAAAGTAACAAGGAACCTGTTCCAAAAGTGTTATTACGG
AAACTGTCATGTTTATTCTTGACTTGCCCCCAATTATTCTTCCCCTG
AAGTTTTTCATCACCAAAAAACCCACATGTGAACCATATGTGTACATA
TGCCCATATTTAAAATACAAATTCTGCACCTGGTTTGCTATTTAAAGT
ATCTCAAAACATATCCATAAGAATACATATGAATGGAACATAATTCTTT
CTCATGGGATATGGGATCTGTTCTATGGACAACATAATTTTTTAACCAG
TCCTAGTATATATACTGGTTTTTTACATGTTGATCTTAAAAAATAA
AAACGGNTGAAA (SEQ ID NO.: 4)

FIG. 4B (1)

CAATTTCTATTNAGTTCTATTAAAAGGGATTTTTTTTNAACTCACTGGNAACCAGGAGGA
CTGNAAAGAAAAGTGAAATGGCTCTGGGACTTTCCTCTAAGGAGACCAGCATGGGTGCGC
CCAATTTTTTATTTTGCACGTATTTGTCCGTTTTTGGCCCATCTCCTCTCTCCTGAAACAC
CAAGACCTTTTTTGAAGCCAAGAGAAATCATTACCCGATTACAAAGAGCATAGAGAGTG
TAACAGTCACTGATCTTGTTCAAATAGGGAGAGTTTTTTTTTCCTTCCCTTTTTGTAAACAC
CTGACCCACAGGACTGACAGTTCTAGGAAGCCCCCTTACCCGAAAATAGGAAATAAATCC
TTGCCACCTTGATTTGCAAGGGCAATGCTAATTTTTTTCTTTCTCCAGAGCTCTCAAAA
AAAAAATAAAAAACCTTACTAAAAACAGGGATCCCGGATGTAGCCTCGATGTCCCCCAT
TAAACGGTAATATTTTCAAGCGTCCGCTCACACTAATCTTTCAAACGTGCATCGCGAGCCG
CCTGGCCAGCAGATTCACTTAACAGCGCTCCCAGGACCCTCGTTCCGAGCTCTTTTCAGC
GAGACATTTAATTGAATCGGATGTGGCTCGTTTGCCAGACGTACCGCCTCGGCGATAGG
CATCCTCTCCAACGACACCCCCCCCCGCGCTCGAAAACAATCTTCAAAGGCAAGG
GGGCCCCCAAGTAGGTTAATTTACAACCATAACGGTAACGTGGCCAAAAGNCAGGCGAG
GAAGGGCCGCAAGGCCGCTGACATGCAAGCTCCGTCCAAGAAGAATTTGGGTGAGGAGTG
AAGAGGTGGGGGGACGAGGTTTCNTGGGCCTTGAACGCCCCACATTTAAAAAAGGCATCC
TCCACAGACTAGACTAACAATTCAGACCCCCAGTAGTCCCTGGCTCAGAACTCGAGGC
GTGATTTGCGCGTGGCAGCCAGGCCTGTTACTGACGGCTGGCGCCTAGAAGCCGGGGTC
AGGGCGTTGCGCGCCTCCTGGGCTGCCCTGCGGGGCTCACCTCTCTCCCAGCATGGAGG
CCCCAGGTCTGGGAGTGTGGCTTTGATGAGGGACAGGAAAAGTCCCAACATCAGGCCAA
TGCTTGACTTCACTTGCGTCCGCGTCTCAGACGGCACACTGTGCGGTTTGAGCACCCAAAG
ATGTACGTTCTGGACAGACACTATTTTGTCCCCATACATGGAGCGTTTCCTCCGCACCTT
GGGCGCGCCTGCGGGAGCTGTGTCTTTAGGTAGTTTTTTGGCCCTGCGCCGCCTTTATTCT
ACTCCAAGCGCTCTTTGCCAAACCCGCACTCCGCAAAGAGCCAAGCCCTCCACATCCCCA
TTCTCAGCAAGTCCACGCGTCCCGCCAGCTTCCCGCCCCGCGGTTCCCTGTACCAGCTAG
GGCCGTGAGAAGCCAACGCTTTTCCACTGACAAATCCTGTATCCCCAGCTCTAGAAGGC
GTCCTTAACCTGGGCCCCGCTCTGCCTGCCCGGACTCCTGAATTGTAAGCAAAATAAACT
CCTCTCTGCAGTGTCTTGGGGAATGGAGAAGACCCCAAGCTTTCATCAGACCCTCCCAAG
GAGTGCGGGGACCCAGAGAAATGAGGCCACCCGGGCAGGATCTGGCCATGTAGCTGGCGC
TCCTGAAACTCTGGCAGATTTGTCTGACTTCTGTGCCCTACTCTACTGACCCTGGGCTAA
AAATGATCATGATCACCCCACTTGCCCTGCCCTTCCCCACGCGCCTGACCGAGCCGCAG
GGGTGCCCCACTGGAAGTCCGGCCCAGAGGCCTCAGAGAAATCCTGGCCTAGCTGGGCTC
AGAGGAGCCCCGCCTCCCTGAGAGCTAAACCTGGGCTAGGACCCTGAAACCTCGAGGTTG
GCAGAAGCCTGAGGGCCTTGCTGCCAGGCAGGGAGGGCACGGGAAGGAGGGAGGTGGGAT
CGATGGCCTCCAAACAGGGGAAACAAGGTGGCTGGTAGCTGGGGCACTCCACAAGACAGG
TGTNTCCTGGGAAGCTGAGCTTACCAGCTGGGATTCCTGATTTATTTATTATTAAGGGG
AGAGGCATTTCCCCTGGGAGGGTACTGGCAGTGACTGATGCCCCCTGGAGTTGTGCTGTG
CATAACACTACTGTAGGAGGCAGCAACTCCTACCCCACTGGCCATCACTCACCTTGCCC
TTACTTTCGTTGATTCGCCCAGAAGCACCCAGAGCCTGCGGCATGATTGACCCTGTAGGC
CAAGCCAAACCAACCCCCGAATTTGTCCAGAATTTTCGCCCTGGTGTATCCCCAAAGCCC
AGCCCTGTCTTTNAGGGTTTTTTTTTCTATTGAGATTTTCCCTCATCCCACCACCTTTAGT
AATAAAGCCTTCCTCAAATAATTTCTCCCCACCGCTTCCCACCCCATCCTTTTTTTTTT
CCCATGCTGGTTTGGGTGCTGAGGAATATTTTTTCAAACCCACACCCATCCAGCCCTGCC
CAGAGGCCTGACTTTGCATGCCTCTGGTAGGNTTTTTCAGGGTTACATTAGGGAGCAAAG
CAGGGTGCAAGGGGCAAAGGGGACCCTTCCAAATGGGTGCTGGCCCCCTTTAAAAAAGCTG
GGCAGGGNTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTGGCGTATGACTATA

FIG. 4B (2)

TTAGGTGACACGAACTGCTCATCGCTCCTGTCATCGAGGCCCCCTGGCCCAATGGCAGGC
TGAGTCCCCCTCCTCTGGCCTGGTCCCGCCTCTCCTGCCCCCTTGCTGCTCAGCGCTACCTG
CTGCCCCGACACATCCAGAGCTGGCCGACGGGTGCGCGGGCGGGCGGCAGGCACCATGCAG
GGAAGCTGCCAGGGGCGGTGGGCAGCGCCGCTTTCTGCCGCCCACCTGGCGCTGTGAGAC
TGGCGCTGCCACCATGTTCCCCAGCCCTGCTCTCACGCCCACGCCCTTCTCAGTCAAAGA
CATCCTAAACCTGGAACAGCAGCAGCGCAGCCTGGCTGCCGCCGAGAGCTCTCTGCCCCG
CCTGGAGGCGACCCCTGGCGCCCTCCTCCTGCATGCTGGCCGCCTTCAAGCCAGAGGCCTA
CGCTGGGCCCCGAGGCGGCTGCGCCGGGCCTCCAGAGCTGCGCGCAGAGCTGGGCGCGC
GCCTTCACCGGCCAAGTGTGCGTCTGCCTTTCCCGCCGCCCCCGCCTTCTATCCACGTGC
CTACAGCGACCCCGACCCAGCCAAGGACCTAGAGCCGAAAAGAAAGGTGAGGAGGAAAC
ACAGGCCCCCTTCTCCCTCCTGGGTGCTTTCTGTCCTCCCAAGAACTCAGGGCCAGGAGG
AGGACACACGCGCCCTTGGGCCGAGGGCTGGGCTGCGGCGGGGGGTTTCAAGATGTAAGAT
GCCTGGTGTTGTGCGCCAGGCTCCCGCGCCCCGCGTCCAATCGGAGGTTTCAAGGAAATGC
CGGATTGAAAGGATCCGAAAGCAAGAGACCAAAAACCTTTTCCCCCGGCCTAACAAACC
CCCGGCGGTTTCCGCTCTGCTCCTGGTTCTGGTAGAATTTTAAAAATCGGTTTATGGTTA
AACAAAACAAAAAACAGCCAAAACCCCCGTTTTTTTACCCCCCCTTGGATTTTCAAACC
CTTTTTTAAATTTTTTGAAAAAAACCCCCAAACAAATTTAAATTTTTTCCCCCAAAAAAT
TTTTTTTTTTTAAACAAAAGGGGGGGTGGAAAATTTTTTTTTTTCCCCCCCCCAAAAGGGGTT
TTTGTTTTTTTTTTT-----TTTNTTTGGCAAAAATGAATTNTGGANCNAGGCCTTAT
TTNAAATGGATATTGGGNCCNCAGGATTTTGATTTTCATTTATTTTTTTTAAAGCAAACCTTNC
CGGGCCGGCAAGGGGAAAGGTTCCCTCGTGGAAGTAGGAAATGCTGCGCTACCGCGGG
CACAAGGNAGTGAGACGAGATGAGTGCGGGATCATCCCGCAGGCCATCCAGGATCGGGGA
GGGAGGCCCGCCCCGCTGCAGAAAGGGGCTTCTGGGAGACCCCCCAGCCCAAGGCAGGAG
CCCGGGCGATTCCCGGGAGGCCGCGAGGCGCTGGGCGAAGCGCTGGGCGAAGGGCCGCTGC
CAGCCGGGAGAGAATTATAGGTTTGTGAGGAGCAGAGGCCTGGGAACAAATTCGGGCG
GGCACGGCGGCTAGAACTGATCGCTACCAATTCAGAGGAAGCCAGCAAGGCAGGTTCCGAG
GCCGCCTGCCACCCCGCAGCTTCTTGGACACTGCGCAAACCTGCTGCGGCCAGGCTGGA
GCCTCCGATCACCAACCAACACTCCCTGGCCTTCTGTTTCTTGATTCTTAATTTTGAG
ATAAGACCGTCCCTAGCAGTGAGGCCTCGGCCTCTGTTCATTTAACTTCTCAAACCAAAC
TAGCCCTAATTCAGTTCACCCAGAGCATCACCTGGTTTTATTTTTTATTTTTTTATTTTT
TTATTTATTTTTTTTTTTTTTTTGCAGCCTGAAATTTTAAAGTCACCGTTTGTCTCCCTCACC
AGGGTGTGAACTGCCCCGAGGGCAGAGACCTCCCGTTTTGTTTTCCAGCGCCTTGAGCCA
GCTTGACTTTTTTACAAATGCTGAGTGAGACGTGTGCGGTGGCTCCAGTGCACTTGGCAGA
GTGAGCCGCAGCCAGCTGGGCGCTCCAGGCAGGACACAGTGGCCTCCACGAGGATCCCTT
ACCATTACTGTGCGGCCGCGCTCCGTAGGTCAAGCCGCTCTTACCAAGCGTCTTTCTGCC
TTTCTGTTCCCCCTCAGAGCTGTGCGCGCTGCAGAAGGCGGTGGAGCTGGAGAAGACAGA
GGCGGACAACGCGGAGCGGCCCCGGGCGCGACGGCGGAGGAAGCCGCGCGTGTCTTCTC
GCAGGCGCAGGTCTATGAGCTGGAGCGGCGCTTCAAGCAGCAGCGGTACCTGTGCGCCCC
CGAACGCGACAGCTGGCCAGCGTGCTGAACTCACGTCCACGCAGGTCAAGATCTGGTT
CCAGAACC GGCGCTACAAGTGCAAGCGGCAGCGGCAGGACCAGACTCTGGAGCTGGTGGG
GCTGCCCCCGCCGCCGCCGCCGCTGCCCGCAGGATCGCGGTGCCAGTGCTGGTGCGCGA
TGGCAAGCCATGCCTAGGGGACTCGGCGCCCTACGCGCCTGCCTACGGCGTGCGGCTCAA
TCCCTACGGTTATAACGCCTACCCCGCCTATCCGGGTACGGCGGCGCGGCCTGCAGCCC
TGGCTACAGCTGCACTGCCGCTTACCCCGCCGGGCTTCCCCAGCGCAGCCGGCCACTGC
CGCCGCCAACAACTTTCGTGAACTTCGGCGTCCGGGACTTGAATGCGGTTTCAAGAGCCC

FIG. 4B (3)

CGGGATTCCGCAGAGCAACTCGGGAGTGTCCACGCTGCATGGTATCCGAGCCTGGTAGGG
AAGGGACCCGCGTGGCGCGACCCTGACCGATCCCACCTCAACAGCTCCCTGACTCTCGTG
GGGAGAAGGGGCTCCCAACATGACCCTGAGTCCCCTGGATTTTGCATTCACTCCTGCGGA
GACCTAGGAACTTTTTCTGTCCCACGCGCGTTTGTCTTGCGCACGGGAGAGTTTGTGGC
GGCGATTATGCAGCGTGCAATGAGTGATCCTGCAGCCTGGTGTCTTAGCTGTCCCCCAG
GAGTGCCCTCCGAGAGTCCATGGGCACCCCCGGTTGGAAGTGGGACTGAGCTCGGGCACC
CAGGGCCTGAGATCTGGCCGCCCATTCGCGAGCCAGGGCCGGGCGCCCGGGCCTTTGCT
ATCTCGCCGTCGCCCCGCCACGCACCCACCCGTATTTATGTTTTTACCTATTGCTGTAAG
AAATGACGATCCCCTTCCCATTAAAGAGAGTGC GTTGACCCCGCACGTGTGCTTCTTTCA
GCTTGCGGCGCTTCAGAAGCAGGAGAGAGGTGGCCGCCCGGGACTGGTCTCAGATCTCAG
GCACAGGCATTCCCTGAGCAAATTGATAACATTGATACTAATAAAACCTAACCCCTTGCTG
GAACCATACTGGTTCCGTGTGCGGCACTTTCTGAGATTGTCTCATATAATCCTCAATAAT
CCAAAAAAAAAAAAATCCTAAAGTTTAGAAGCTGAGGCCCGGAGAGGTTTAATGACTTAC
CTGCGAGCAAATAGCCAGTACTAGTCGAACTCTGGTTAAATTCAGGATGCCTCACTTCAG
AGACCGCCTTCCCTGTGCTCCCAAGCTCCCTCCTTGAATCCTAATGTGTGCCAGGCACG
GTTCCAGGCACTGGGCATTAAATGGACAAGCAAAGAACCTGGGCCCTCTGTAGCTGGAG
AGCACCGTGATCATCCCACTTAAAAGAACTCCTTAACCTGTTTCCAAGATGGNAAAAGCC
AAGAANCCAAAGCCCTTGGGNAAGCGTTCTCAAGGGTCCTCANATGCCCCAAATGCCACG
TCGGGGGCTCAACANCTNGCCCGTTGGAAGTGAATGCCNANGGTGGGCCCCAAANAAGGN
TCCTGCGGGATGGNGCTCAACTCCAAGCTGTGGTGAAGGCCCATAAAATTCAAATGGGCC
AAGGGGAGCCCCCTAAAGCCCTAAACCTTCNGGGGGTCCNTTCCCTAAGGGCATTTAANT
TTACCAAAGTTTGGNCAAANAATGTTTCCAATGGNCCNGATTTTATNGANGGGNAAAAC
TGGNGGGCAACCGAAATCCAGTTTAAACCCGGGTTGTTT (SEQ ID NO.: 5)

FIG. 5A

AGGCCCCCCG CACCCTCATC CTGGCTCCCG CCCCTTCTCT CCACCCTCCC
GGACCCCTAA AGGGGCGGCG GGGCCCAAGC CGAGGGCGCT GCGCCTGACC
CCGAGCGGAA GGGCCCCAGT CTAGGTCCTA ATGCGGGTGG CGTCTCCTTT
GACAGGCGGC GTTTGGGGAC AACAGCGGGG ACGAGAGATA AGGTGACATA
CCAGAGCAGA TTTGGTGCGC GCGCTGATAC TCCTCTCCCG ACAGGAAACG
CGGAGCTATT TAAAAGACCC TATCGATTAC TTTATCTTTC CTGGAAAGCT
TCTTGCGGAG AGACAAAAGA TGTTCCCTGC CTAAAGACAC AAGGCCACAC
AACGGAGGGT CTGCACAGGC GACGC (SEQ ID NO.: 1)

TGCTCCTTT TAAGGGCTTG AATGTCTGCA ACTGTCATGT GTACACTTAA
AG (SEQ ID NO.: 2)

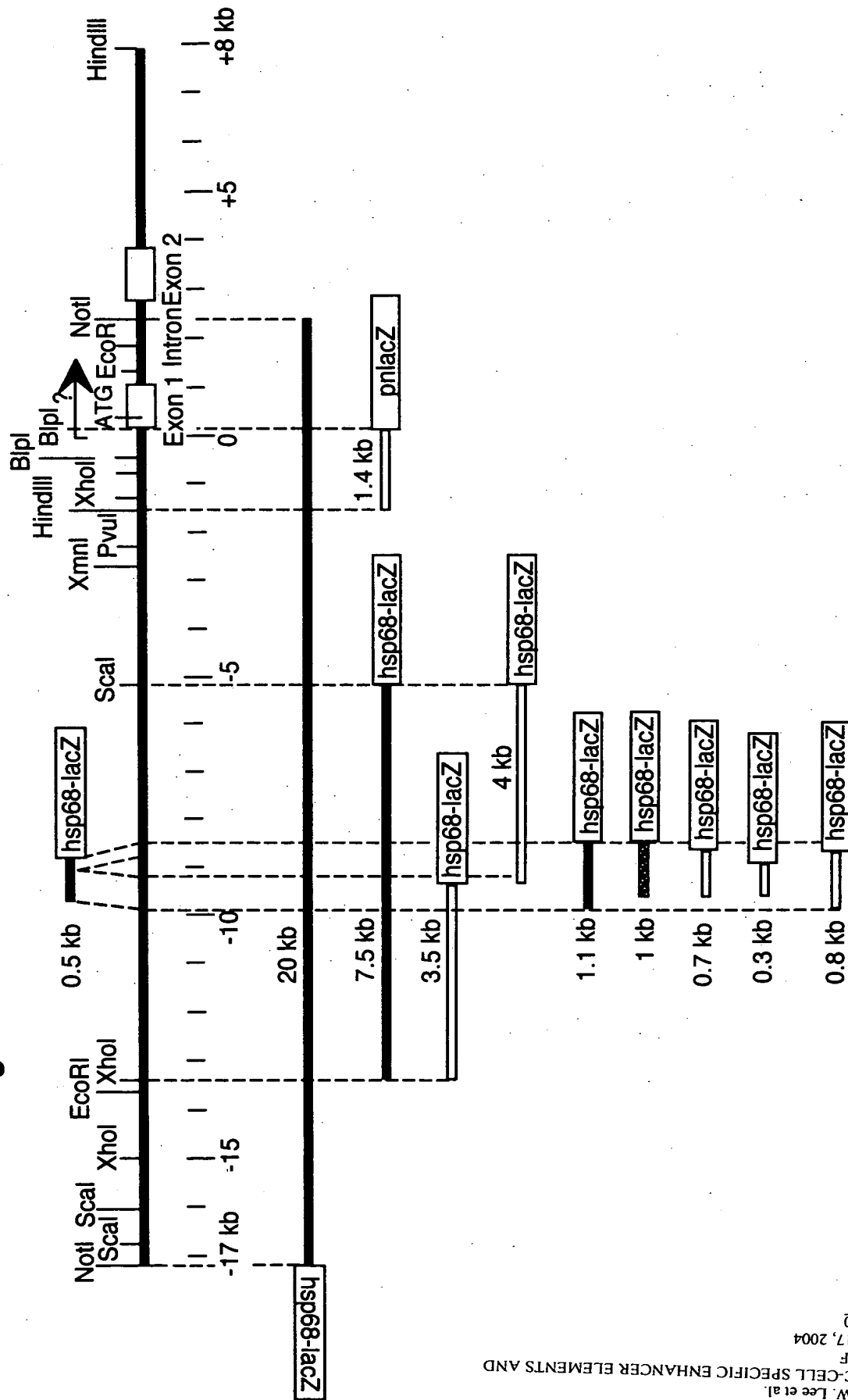
FIG. 5B

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AGGCCCCCCG CACCCTCATC CTGGCTCCCG CCCCTTCTCT CCACCCTCCC
GGACCCCTAA AGGGGCGGCG GGGCCCAAGC CGAGGGCGCT GCGCCTGACC
CCGAGCGGAA GGGCCCCAGT CTAGGTCCTA ATGCGGGTGG CGTCTCCTTT
GACAGGCGGC GTTTGGGGAC AACAGCGGGG ACGAGAGATA AGGTGACATA
CCAGAGCAGA TTTGGTGCGC GCGCTGATAC TCCTCTCCCG ACAGGAAACG
CGGAGCTATT TAAAAGACCC TATCGATTAC TTTATCTTTC CTGGAAAGCT
TCTTGCGGAG AGACAAAAGA TGTTCCTGTC CTAAAGACAC AAGGCCACAC
AACGGAGGGT CTGCACAGGC GACGCACAAT TCGGCGCGGG GAAAGCAAAA
ACACACTGAC GCTTAGAGTG CACAAACGTG TGTGTTCCCA GAGCAGCTCC
AGAGTGCGGC AGGGACGCTG GGGGCGGCGA GGGGCACCCA CAGTATGGTC
TTCTGTGCCC TTGGAAAGTT TTTTTCACC GTATGCGCGT AAAACACGCA
CACACAGAGA AAGTGACTGT GCACTTAGGG CGCCTGTGTG TACCCGTGTC
GTTTTAGCGA ATTTAAAGCA CATCAGGCCG GCGGCCATGG CTCACGCCTG
TAATCCCAGC ACTTTAGGAG GCCGAGGCGG GCCGATCACC TGAGGTCGGG
AGTTCGACAC CAGCCTGGCC AACATGGTGA AACCCTGTCT CTACAAAAAA
TACAAAAATT AGCCGGGCAT GGTGATGCGT GCCTGTGATC CCAGCTACTC
GGGAGGCTGA GGCAGGAGAA TCGCTTGAAC CCGGGAGGCG GAGGTTGCAG
TGAGCCGAGA TCACACCACT GCACTCCAGC CTGGGCGACA AGAGCGAAAT
TCCGTCTAAA AAAATAAAAT AAAATAAAAT GATAATTAAG CCCATCAACT
CACATTCAA GCGGTTACTG GTGGTTGTAA TGTATCCATA GACACAGGTC
TAAAATGTAA ACGCTCCATT GTGCTCCTTT TAAGGGCTTG AATGTCTGCA
ACTGTCATGT GTACACTTAA AG (SEQ ID NO.: 3)
```

FIG. 5C

AGAGAAATCA TTACCCGATT CACAAAGAGC ATAGAGAGTG TAACAGTCAC
TGATCTTGTT CAAATAGGGA GAGTTTTTTT TCCTTCCCTT TTTGTAACAC
CTGACCCACA GGACTGACAG TTCTAGGAAG CCCCCTTACC CGAAAATAGG
AAATAAATCC TTGCCACCTT GATTTGCAAG GGCAATGCTA ATTTTTTTCT
TTCTCCAGAG CTCTCAAAAA AAAAAAAAAA AAAACCTTAC TAAAAACAGG
GATCCCGGAT GTAGCCTCGA TGTCCCCCAT TAAACGGTAA TATTTCAGGC
GTCCGCTCAC ACTAATCTTT CAAACTGTCA TCGCGAGCCG CCTGGCCAGC
AGATTCACTT AACAGCGCTC CCAGGACCCT CGTTCCGAGC TCTTTTCAGC
GAGACATTTA ATTGAATCGG ATGTGGCTCG TTTGCCAGAC GTCACCGCCT
CGGCGATAGG CATCCTCTCC AACGACAC (SEQ ID NO.: 6)

FIG. 6 Transgenic Constructs of the Human Csx/Nkx2-5 Enhancer



Seq ID No: 5

Seq ID No: 4

FIG. 7

Transgenic Analysis of the Human Csx Enhancer Sequence

<u>Constructs</u>	<u># of Transgenes</u>	<u>Enhancer positives (Cardiac : Ectopic)¹</u>
20 kb	8	4 : 0
7.5 kb	8	6 : 1
promoter-proximal 4 kb	7	0 : 1
promoter-distal 3.5 kb	6	0 : 0
1.1 kb	8	3 : 1
1.0 kb	10	1 : 2
0.7 kb	8	0 : 3
0.3 kb	11	0 : 6
0.8 kb	6	0 : 1
0.5 kb	2	2 : 0

1. Each embryo was classified into either 'cardiac' or 'ectopic' judged upon the extent of similar to the endogenous Csx expression pattern.

FIG. 8

Cardiac Expression of the hCsx Enhancer-hsp68-lacZ Constructs

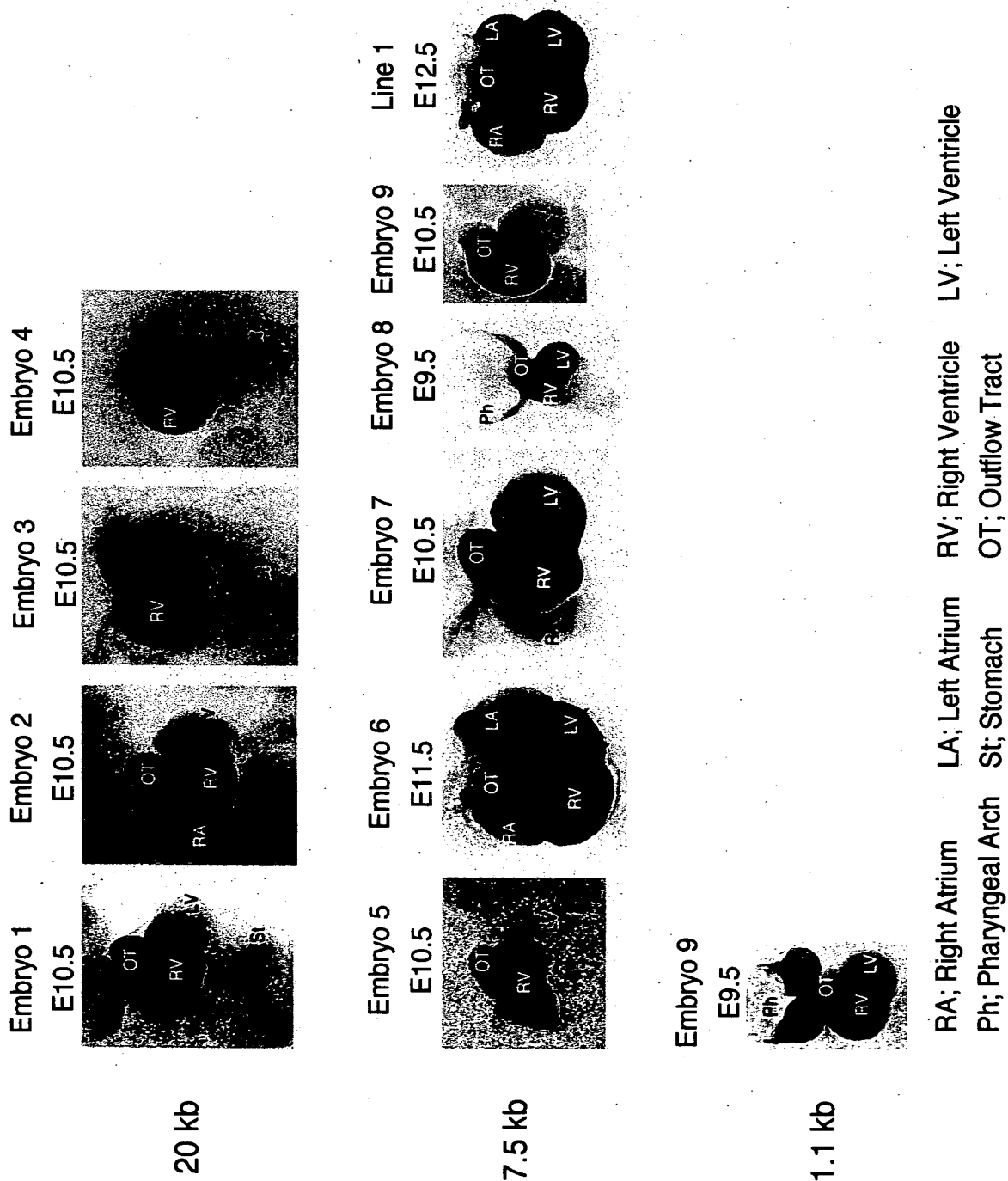


FIG. 9

Cardiac Expression of the 7.5 kb hCsx Enhancer-hsp68-lacZ Construct

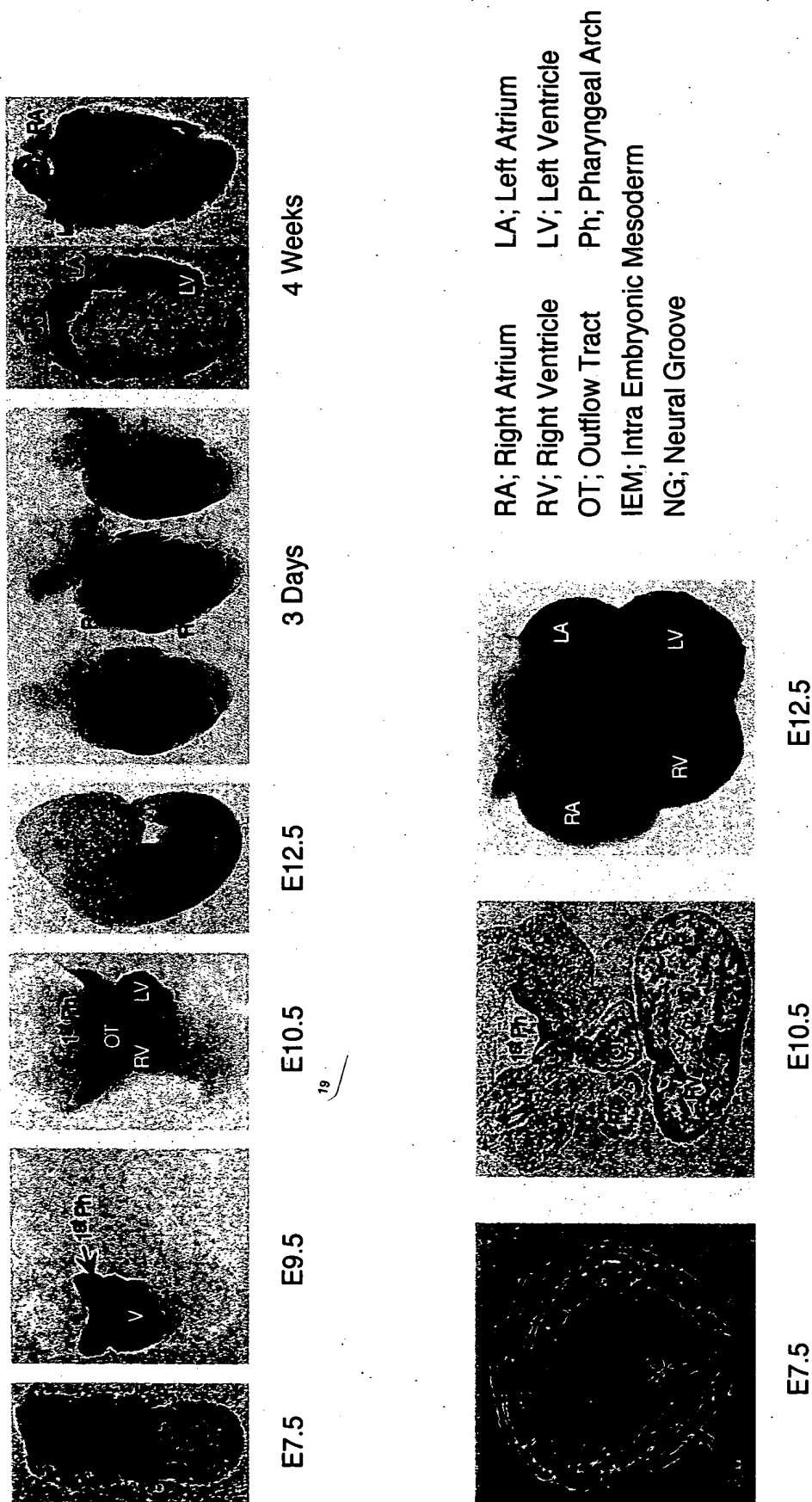


FIG. 10

